Attachment B

Soil Screening DQOs for Surface Soils and Subsurface Soils

Table B.1
Soil Screening DQOs for Surface Soils Using the Max Test

DQO Process Steps	Soil Screening Inputs/Outputs
State the Problem	
Identify scoping team	Site manager and technical experts (e.g., health physicists, risk assessors, statisticians)
Develop conceptual site model (CSM)	CSM development (described in Step 1)
Define exposure scenarios	Direct ingestion of soil, inhalation of fugitive dusts, external radiation exposure, and ingestion of homegrown produce in a residential setting;
Specify available resources	Sampling and analysis budget, scheduling constraints, and available personnel
Write brief summary of contamination problem	Summary of the surface soil contamination problem to be investigated at the site
Identify the Decision	
Identify decision	Do mean soil concentrations for particular radionuclides (e.g., radionuclides of potential concern) exceed appropriate screening levels?
Identify alternative actions	Eliminate area from further study under CERCLA or Plan and conduct further investigation
Identify Inputs to the Decision	
Identify inputs	SSLs for each pathway for specified radionuclides Measurements of surface soil radionuclide concentration
Define basis for screening	Soil Screening Guidance for Radionuclides
Identify analytical methods	Feasible analytical methods (both field and laboratory) consistent with program-level requirements
Define the Study Boundaries	
Define geographic areas of field investigation	The entire NPL site, (which may include areas beyond facility boundaries), except for any areas with clear evidence that no contamination has occurred
Define population of interest	Surface soils (usually the top 15 centimeters)
Divide site into strata	Strata may be defined so that radionuclide concentrations are likely to be relatively homogeneous within each stratum based on the CSM and field measurements
Define scale of decision making	Exposure areas (EAs) no larger than 0.5 acre each (based on residential land use)
Define temporal boundaries of study	Temporal constraints on scheduling field visits
Identify practical constraints	Potential impediments to sample collection, such as access, health, and safety issues
Develop a Decision Rule	
Specify parameter of interest	"True mean" (μ) individual radionuclide concentration in each EA. However, since the determination of the "true mean" would require the collection and analysis of many samples, another sample statistic, the maximum composite concentration, or "Max Test" is used.
Specify screening level	Screening levels calculated using available parameters and site data (or generic SSLs if site data are unavailable)
Specify "if..., then..." decision rule	Ideally, if the "true mean" EA concentration exceeds the screening level, then investigate the EA further. If the "true mean" is less than the screening level, then no further investigation of the EA is required under CERCLA.

Table B.1
Soil Screening DQOs for Surface Soils Using the Max Test (continued)

DQO Process Steps	Soil Screening Inputs/Outputs
Specify Limits on Decision Errors*	
Define baseline condition (null hypothesis)	The EA needs further investigation
Define the gray region**	From 0.5 SSL to 2 SSL
Define Type I and Type II decision errors	Type I error: Do not investigate further ("walk away from") an EA whose "true mean" exceeds the screening level of 2 SSL Type II error: Investigate further when an EA "true mean" falls below the screening level of 0.5 SSL
Identify consequences	Type I error: potential public health consequences Type II error: unnecessary expenditure of resources to investigate further
Assign acceptable probabilities of Type I and Type II decision errors	Goals: Type I: 0.05 (5%) probability of not investigating further when "true mean" of the EA is 2 SSL Type II: 0.20 (20%) probability of investigating further when "true mean" of the EA is 0.5 SSL
Define QA/QC goals	Analytical laboratory precision and bias requirements 10% laboratory analyses for field methods
Optimize the Design	
Determine how to best estimate "true mean"	Samples composited across the EA as physical estimates of EA mean ($\bar{x}$). Use maximum composite concentration as a conservative estimate of the true EA mean.
Determine expected variability of EA surface soil radionuclide concentrations	A conservatively large expected coefficient of variation (CV) from prior data for the site, field measurements, or data from other comparable sites and expert judgment. A minimum default CV of 2.5 should be used when information is insufficient to estimate the CV.
Design sampling strategy by evaluating costs and performance of alternatives	Lowest cost sampling design option (i.e., compositing scheme and number of composites) that will achieve acceptable decision error rates
Develop planning documents for the field investigation	Sampling and Analysis Plan (SAP) Quality Assurance Project Plan (QAPP)

* Since the DQO process controls the degree to which uncertainty in data affects the outcome of decisions that are based on that data, specifying limits on decision errors will allow the decision maker to control the probability of making an incorrect decision when using the DQOs.

** The gray region represents the area where the consequences of decision errors are minor, (and uncertainty in sampling data makes decisions too close to call).

Table B.2
Soil Screening DQOs for Subsurface Soils

DQO Process Steps	Soil Screening Inputs/Outputs
State the Problem	
Identify scoping team	Site manager and technical experts (e.g., health physicists, risk assessors, hydrogeologists, statisticians).
Develop conceptual site model (CSM)	CSM development (described in Step 1).
Define exposure scenarios	Migration of radionuclides from soil to potable ground water.
Specify available resources	Sampling and analysis budget, scheduling constraints, and available personnel.
Write brief summary of contamination problem	Summary of the subsurface soil contamination problem to be investigated at the site.
Identify the Decision	
Identify decision	Do mean soil concentrations for particular radionuclides (e.g., radionuclides of potential concern) exceed appropriate SSLs?
Identify alternative actions	Eliminate area from further action or study under CERCLA or Plan and conduct further investigation.
Identify Inputs to the Decision	
Identify decision	Migration to ground water SSLs for specified radionuclides Measurements of subsurface soil radionuclide concentration
Define basis for screening	Soil Screening Guidance for Radionuclides
Identify analytical methods	Feasible analytical methods (both field and laboratory) consistent with program-level requirements.
Specify the Study Boundaries	
Define geographic areas of field investigation	The entire NPL site (which may include areas beyond facility boundaries), except for any areas with clear evidence that no contamination has occurred.
Define population of interest	Subsurface soils
Define scale of decision making	Sources (areas of contiguous soil contamination, defined by the area and depth of contamination or to the water table, whichever is more shallow).
Subdivide site into decision units	Individual sources delineated (area and depth) using existing information or field measurements (several nearby sources may be combined into a single source).
Define temporal boundaries of study	Temporal constraints on scheduling field visits.
Identify (list) practical constraints	Potential impediments to sample collection, such as access, health, and safety issues.

Table B.2
Soil Screening DQOs for Subsurface Soils(continued)

Develop a Decision Rule	
Specify parameter of interest	Mean soil radionuclide concentration in a source (i.e., discrete radionuclide concentrations averaged within each boring).
Specify screening level	SSLs calculated using available parameters and site data (or generic SSLs if site data are unavailable).
Specify "if..., then..." decision rule	If the mean soil concentration exceeds the SSL, then investigate the source further. If mean soil concentration in a source is less than the SSL, then no further investigation is required under CERCLA.
Specify Limits on Decision Errors	
Define QA/QC goals	Analytical laboratory precision and bias requirements 10% laboratory analyses for field methods
Optimize the Design	
Determine how to estimate mean concentration in a source	For each source, the highest mean soil boring concentration (i.e., depth-weighted average of discrete radionuclide concentrations within a boring).
Define subsurface sampling strategy by evaluating costs and site-specific conditions	Number of soil borings per source area; number of sampling intervals with depth.
Develop planning documents for the field investigation	Sampling and Analysis Plan (SAP) Quality Assurance Project Plan (QAPP)